New technology could reduce wind energy costs

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The Shepherds Flat Wind Farm is an 845 MW wind farm in the U.S. state of Oregon. Credit: Steve Wilson / Wikipedia.

Engineers from the University of Sheffield have developed a novel technique to predict when bearings inside wind turbines will fail which could make wind energy cheaper.

The method, published in the journal *Proceedings of the Royal Society A*

and developed by Mechanical Engineering research student Wenqu Chen, uses ultrasonic waves to measure the load transmitted through a ball bearing in a wind turbine. The stress on wind turbine is recorded and then engineers can forecast its remaining service life.

When a bearing is subject to a load, its thickness is reduced by a very small amount due to elastic deformation, and the speed of sound is affected by the stress level in the material. Both these effects change the time of flight of an ultrasound wave through a bearing.

The new method is the only way to directly measure the transmitted load through the rolling bearing components. It uses a custom-built piezoelectric sensor mounted in the bearing to measure the time of flight and determine the load. This sensor is less expensive and significantly smaller than currently available, making it suitable for smaller turbines. It can also provide a better prediction of the maintenance needed, saving money in servicing.

Professor Rob Dwyer-Joyce, co-author of the paper and Director of the Leonardo Centre for Tribology at the University of Sheffield says: "This technique can be used to prevent unexpected bearing failures, which are a common problem in wind turbines. By removing the risk of a loss of production and the need for unplanned maintenance, it can help to reduce the cost of wind energy and make it much more economically competitive."

The new technology has been validated in the lab and is currently being tested at the Barnesmore wind farm in Donegal, Ireland by the company, Ricardo. It is hoped it will be used in the future inside monitoring systems for other turbines.

More information: W. Chen, R. Mills, R. S. Dwyer-Joyce (2015) Direct load monitoring of rolling bearing contacts using ultrasonic time

of flight. *Proceedings of the Royal Society A*. Volume: 471 Issue: 2180

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